Box 1
Instantaneous inflation in Colombia[1]

Edgar Caicedo García
Wilmer Osvaldo Martínez Rivera
Juan Camilo Vallejo Peña
Gabriel Adolfo Garavito Plata*

Annual inflation is computed using the consumer price index (CPI), the twelve months included in this calculation are weighted equally. Consequently, price variations during the period analyzed may lead to an underestimation or overestimation of the significance of the information included in the most recent inflation concerning inflationary dynamics. Nevertheless, the measure of instantaneous inflation for Colombia provides an alternative to correct this bias, calculated by assigning greater weight to the most recent data and reducing the influence of more remote data through a Kernel function. This potential bias resulting from the overweighting of older data exists because information from more distant months may be less relevant for understanding the current behavior of consumer prices. In addition, we explore below the possibility of instantaneous inflation presiding over official annual inflation.

1. Biases in the CPI calculation

Since the United States Senate-appointed Boskin Commission reported its findings in 1996, it has been widely recognized that a CPI calculation employing a Laspeyres-type formula may generate biases in recording changes in consumer prices. A numerical Laspeyres index that maintains a fixed basket does not allow for the timely incorporation of new goods or the substitution of more expensive goods or services for lower-price alternatives (substitution in consumption). Nor does it allow for updating the quality of goods, incorporating new outlets, or more efficient distribution networks in the measurement. In addition, there is a bias in the selected products since statistical institutions do not collect information on the price changes of the entire consumer basket but only on those most frequently consumed goods that have a more significant impact on household spending.

Recently, Eeckhout (2023) introduced the bias of obsolete information derived from giving equal weight to each of the twelve months that comprise annual inflation. This weighing generates a particular bias due to the under-representation of the price levels of recent months, which have a greater impact on inflation dynamics. Consequently, assigning a greater weight to more recent values when calculating annual CPI variations is reasonable for gaining a clearer understanding of more contemporary price dynamics. Eeckhout (2023) calls this calculation "instantaneous inflation which will be explained below for Colombia's case.

2. Methodology

Differentiated and increasing weights will be used to offset the bias we have coined as old data bias. To determine the weights, Eeckhout (2023) suggests using the following polynomial Kernel function:

$$\kappa(\tau,\alpha)=\frac{(\mathrm{T}-\tau)^{\alpha}}{\sum_{\tau=0}^{\mathrm{T}-1}(\mathrm{T}-\tau)^{\alpha}}\mathrm{T},\forall\alpha\geq 0$$

* The authors are, in order, leading professionals, researchers, and interns in the Programming and Inflation Department. The opinions are the authors' own and do not reflect the views of *Banco de la República* or its Board of Directors.

1 This box coincides with the recent publication of the Economics Draft by Martínez et al. (2025), entitled: "Instantaneous Inflation as a Predictor of Inflation," whose content focuses on the predictive capacity of instantaneous inflation toward annual inflation for Colombia, the United States, and England. This box, in some sections, is similar to that presented in Martínez et al. (2025).

Where T-τ represents each of the periods (months), adding a parameter α to determine the magnitude of the weight of each period in the Kernel. The higher the value of α, the greater the weight of the most recent months and the lower the weight of the most remote months. When the value of α is 0 (zero), this would result in conventional inflation, where all periods (months) have the same weight. Graph B1.1 shows the behavior of the Kernel at different values of α.

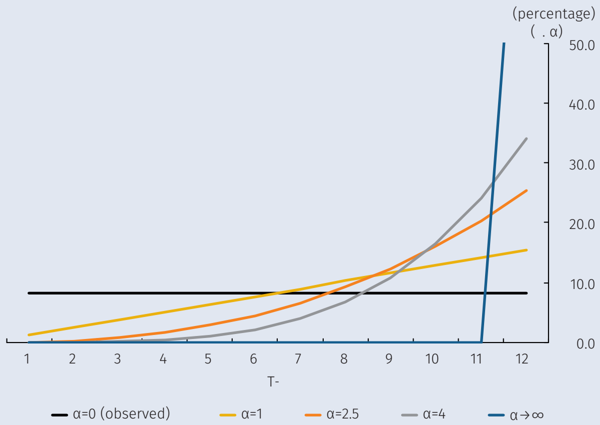
Subsequently, the Kernel is applied to the original inflation function, obtaining the following for instantaneous inflation:

$$i_t^{\kappa} = \prod_{\tau=0}^{11} (1 + i_{t-\tau}^{m})^{\kappa(\tau)} - 1$$

Where $(1 + i_{t-\tau}^{m})$ is the monthly variation for each period.

It is essential to take into account several considerations regarding instantaneous inflation. The higher the value of parameter α, the greater the response of inflation to varied factors, such as noise that might have occurred in the data collection process or resulting from seasonal factors. Consequently, instantaneous inflation tends to be more volatile than conventional inflation, especially when very high α values are used. To counteract this, we have seasonally adjusted the CPI series used to calculate the different instantaneous inflations in this paper. Graph B1.2 (panels A and B) represents the reduced volatility once the CPI is seasonally adjusted to compute instantaneous inflation using a value of α= 2.5, selected for the reasons explained in the following section.

Graph B1.1
Kernel weights in percentages for different values of α



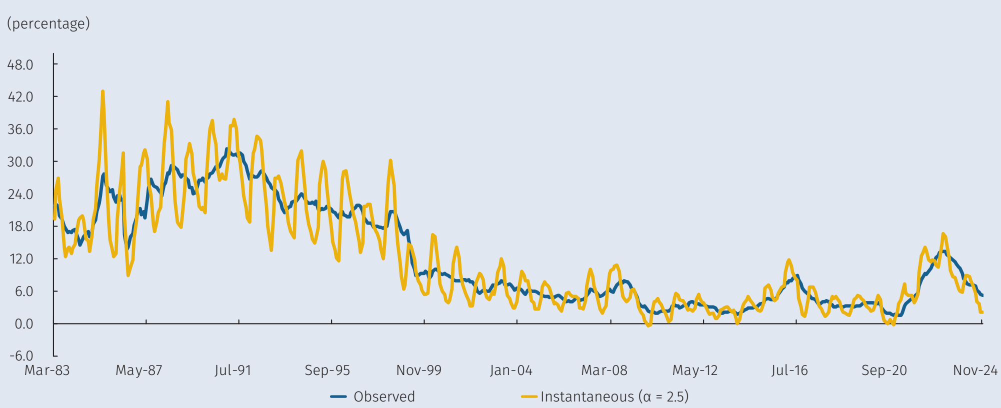
Sources: DANE; own calculations.

3. Parameter α value selection α

Three criteria were employed to determine an adequate value for α, considering that, although there may be an adequate range of values, using a non-integer value will provide a better approximation, counter to the selection used by Eeckhout (2023). The first criterion used in selecting α assesses its values based on a cumulative percentage of Kernel weights, choosing those that reached a threshold of 90% for

Graph B1.2
Instantaneous inflation

A. Instantaneous and observed inflation



Graph B1.2 (continued)

B. Seasonally adjusted instantaneous and observed inflation

(percentage)

Sources: DANE; own calculations.

T-τ== 7, which necessitates that the cumulative weight of the six oldest periods (months) does not exceed 10% of the total weight. This criterion is met from α= 2.5 to α=100. This approach allows for identifying an α value high enough to effectively convey the most up-to-date information to consumer prices while simultaneously reducing the bias of the older information, as shown in Table B1.1.

The second criterion, the volatility of total seasonally adjusted instantaneous inflation, assesses different values of α from March 1983 to November 2023, considering those values of this parameter with the lowest variance as superior (Table B1.2, panel A). As a third criterion, the mean squared error (MSE) between observed annual inflation and its instantaneous seasonally adjusted version was calculated for different values of α, choosing again the values that minimized it (Table B1.2, panel B). Even when assigning the value of α= 2.5 to calculate instantaneous inflation, it still yields an indicator that is among those resulting in the lowest MSE for inflation forecasting.[2] Although there is a range of optimal values for α, α= 2.5 was selected based on the three criteria because it allows for excluding at least 90% of the most distant data and simultaneously has a smaller variance and mean squared error. Although a value of α<2.5 generates less volatility and a lower mean squared error, these values assign a

2 For more information see Martínez, et al (2025).

Table B1.1
Cumulative percentage of Kernel weights for different α values

T-τ	α = 0	α = 1	α = 2	α = 2,5	α = 3	α = 4	α = 5	α = 6	α = 12	α = 100
12	8.33	15.38	22.15	25.34	28.40	34.16	39.45	44.33	66.43	99.98
11	16.67	29.49	40.77	45.73	50.28	58.27	64.99	70.63	89.81	100.00
10	25.00	42.31	56.15	61.80	66.72	74.74	80.84	85.47	97.26	100.00
9	33.33	53.85	68.62	74.14	78.70	85.55	90.21	93.36	99.37	100.00
8	41.67	64.10	78.46	83.34	87.11	92.30	95.40	97.26	99.88	100.00
7	50.00	73.08	86.00	89.92	92.75	96.25	98.07	99.00	99.98	100.00
6	58.33	80.77	91.54	94.40	96.30	98.39	99.30	99.70	100.00	100.00
5	66.67	87.18	95.38	97.24	98.36	99.42	99.79	99.93	100.00	100.00
4	75.00	92.31	97.85	98.87	99.41	99.84	99.96	99.99	100.00	100.00
3	83.33	96.15	99.23	99.66	99.85	99.97	99.99	100.00	100.00	100.00
2	91.67	98.72	99.85	99.95	99.98	100.00	100.00	100.00	100.00	100.00
1	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: DANE; own calculations.

Table B1.2
Variance of instant inflation and mean squared error for the different α values

A. Variance of seasonally adjusted annual instant inflation for the different α values
(March 1983 to November 2024)

	α = 0	α = 1	α = 2	α = 2,5	α = 3	α = 4	α = 5	α = 6	α = 12	α = 100
Variance	83.12	83.86	85.41	86.23	87.02	88.53	89.92	91.19	96.89	106.89

B. Mean squared error for the different α values
(seasonally adjusted instantaneous annual inflation vs. observed annual inflation)

	α = 1	α = 2	α = 2,5	α = 3	α = 4	α = 5	α = 6	α = 12	α = 100
Mean squared error	1.19	2.96	3.82	4.64	6.17	7.55	8.80	14.46	24.32

Sources: Dane; own calculations

higher weight to older information, which is not ideal. Consequently, instantaneous inflation will be calculated using an α= 2.5 value.

4. Results

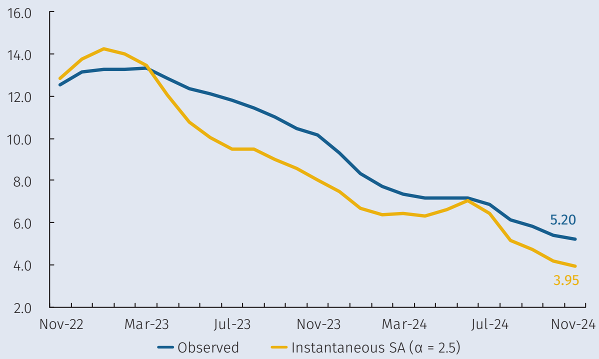
For a better understanding of the recent inflationary dynamics, instantaneous inflation will be computed not only for the total CPI and the CPI excluding food and regulated items but also for four subcategories: goods and services (excluding food and regulated items for both), as well as food and regulated items. In addition, the coincident profile methodology proposed by Martinez et al. (2013) will be applied to assess whether instantaneous inflation serves as a leading indicator of conventional observed inflation. This methodology uses an algorithm that identifies inflection points in annualized series to identify when one series anticipates the inflection points of another and the number of periods (months) over which it does so at a 10% level of statistical significance. Graphs B1.3 to B1.8 present the calculations for each grouping, comparing observed inflation and seasonally adjusted instantaneous inflation calculated using α= 2.5.

Graphs B1.3 to B1.8 suggest that seasonally adjusted annualized instantaneous inflation in November 2024 is lower than official annual inflation for all CPI segments analyzed, except for goods and core inflation excluding food and regulated items (panels A). Furthermore, it is proven that seasonally adjusted annual instantaneous inflation can anticipate annual consumer price adjustments (panel B). The results of the coincident profile graphs illustrate that seasonally adjusted annual instantaneous inflation for the total CPI and the CPI excluding food and regulated items, as well as that of the food group, have significant lags of two to four months, with a three-month lag being the most prevalent. Similarly, the services and regulated items groups present significant lags of between one and three months, with a three-month lag having the highest probability of occurrence. Finally, the seasonally adjusted instantaneous annual inflation for the goods CPI, excluding food and regulated items, foreshadows its official version by three to five months, with a four-month lag having the highest probability of occurrence. These results suggest that instantaneous inflation anticipates possible changes in the inflation of the different baskets and is a valuable indicator when attempting to anticipate inflation dynamics, which is especially helpful in the realm of monetary policy decisions. With information to November, instantaneous inflation projected possible reductions in annual food, regulated items, and services inflation and a probable variation in the trend of goods inflation, perhaps as a result of recent exchange rate pressures endured by the Colombian economy.

Graph B1.3
Instantaneous inflation for the total basket and coincident profile

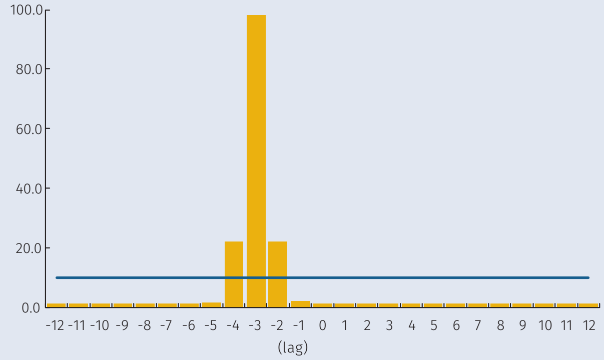
A. Headline inflation

(percentage)



B. Coincident profile

(p-value)

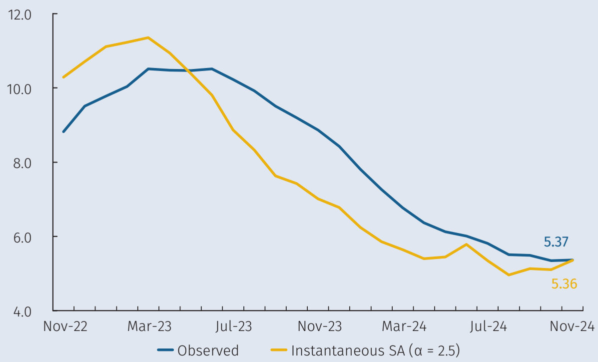


Sources: DANE; own calculations.

Graph B1.4
Instantaneous inflation for the total basket excluding food and regulated items and coincident profile

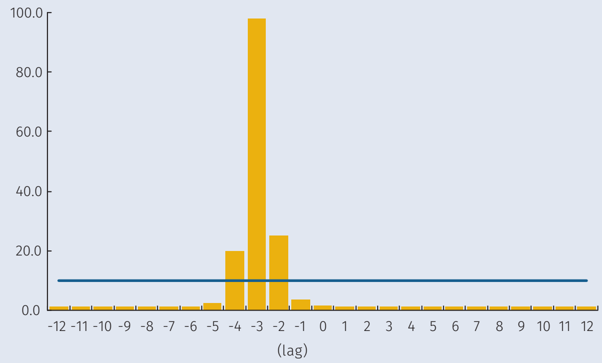
A. Core inflation (excluding food and regulated items)

(percentage)



B. Coincident profile

(p-value)

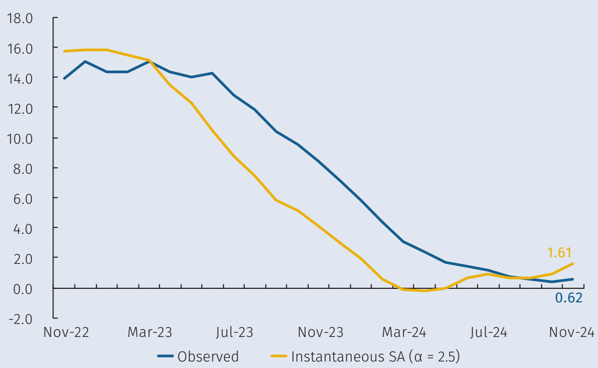


Sources: DANE; own calculations.

Graph B1.5
Instantaneous inflation for goods and coincident profile

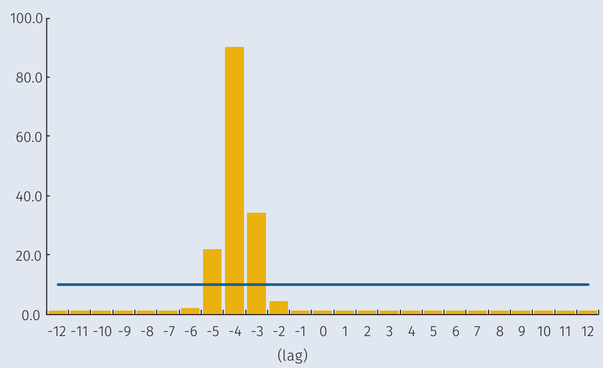
A. Goods inflation

(percentage)



B. Coincident profile

(p-value)

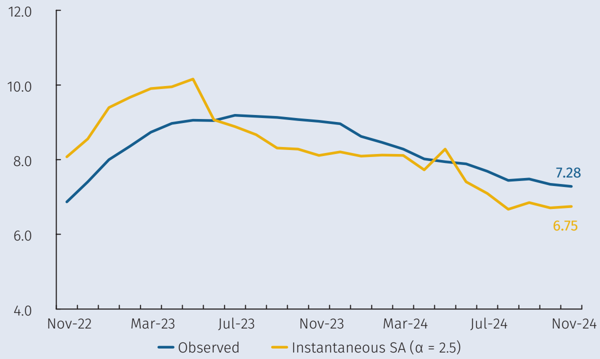


Sources: DANE; own calculations.

Graph B1.6
Instantaneous inflation for services and coincident profile

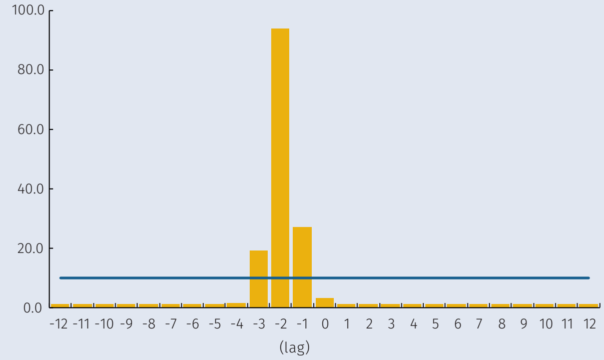
A. Services inflation

(percentage)



B. Coincident profile

(p-value)

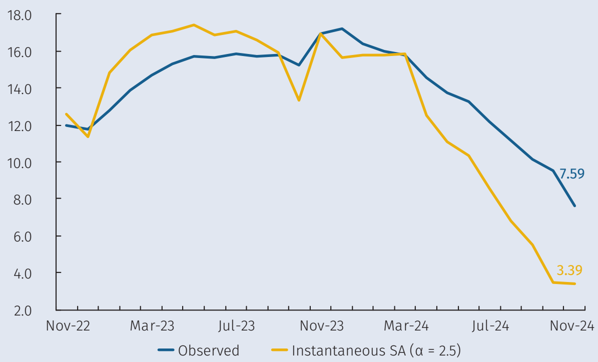


Sources: DANE; own calculations.

Graph B1.7
Instantaneous inflation for regulated items and coincident profile

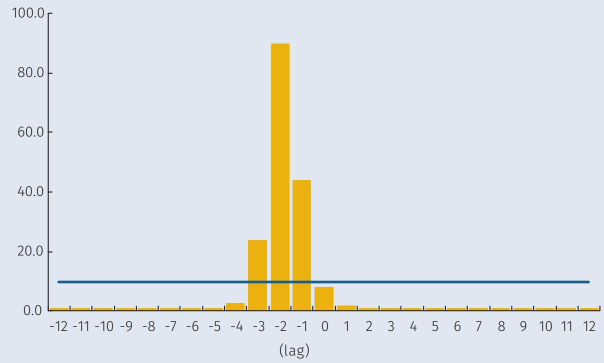
A. Services inflation

(percentage)



B. Coincident profile

(p-value)

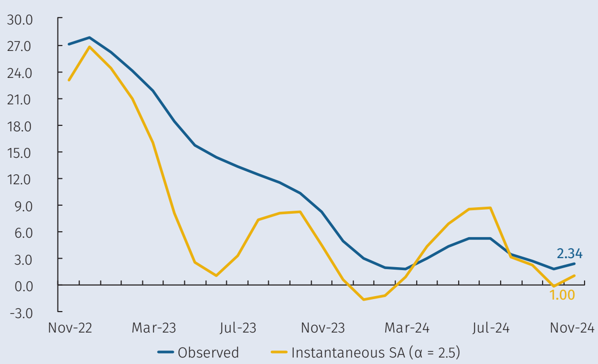


Sources: DANE; own calculations.

Graph B1.8
Instantaneous inflation for food and coincident profile

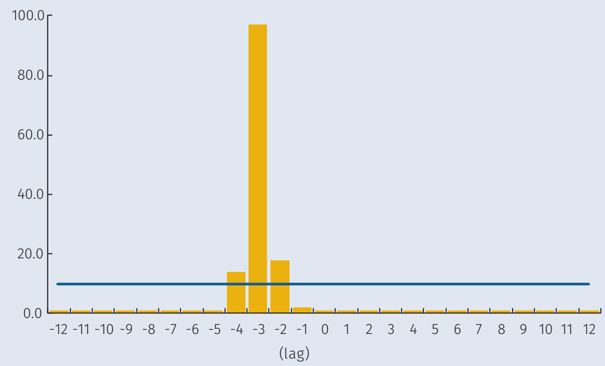
A. Services inflation

(percentage)



B. Coincident profile

(p-value)



Sources: DANE; own calculations.

5. Conclusions

The figure of instantaneous inflation captures more recent information on consumer price dynamics, providing timely data on recent inflation behavior and the likely short-term performance of annual inflation. Instantaneous inflation significantly reduces the bias that lagged data can introduce in the computation of annual inflation behavior, the most commonly used conventional inflation indicator. Moreover, incorporating novelties into the benchmark methodology, such as the use of coincident profiles to anticipate possible changes in official annual inflation trends, allows us to note that this new indicator leads the inflationary trajectory of all CPI segments analyzed. Consequently, instantaneous inflation is an ideal complementary tool for monitoring consumer prices, anticipating possible changes in the inflationary path, and providing additional information for monetary policy decision-making.

References

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